The Effect of Team Learning Behaviours on Team Effectiveness in Virtual Teams

A dissertation submitted in the partial fulfilment of the requirements for the Degree of Master of Science in Applied Psychology

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2018

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Abstract

The present study serves as an updated study on team virtuality in relation to team effectiveness and team learning behaviour. Because computer-mediated communication that virtual teams are based on is improving every year, and because the global workforce is increasingly exposed to and becoming comfortable with technology, older research on virtual teams might prove to be outdated. Also, past research has not taken a deeper look into the reasons for virtuality's effects on team effectiveness, particularly in relation to team learning behaviours.

Through a worldwide survey of individuals who are part of work teams, the present study was able to find that different aspects of virtuality affected or related to team effectiveness differently. Workplace mobility was negatively related to team performance errors, but team distribution was significantly negatively related to team performance. Variety of practices negatively moderated two of the team learning behaviour to team effectiveness relationships, but team distribution positively moderated a similar team learning behaviour to team performance relationship. Overall, virtuality is not simply the obstacle to team effectiveness as past research has painted it to be, but may be more complex than originally thought. It is hoped that the present study will update researchers on the current state of virtual team research, and inspire more practical future research.

Keywords: Virtual Teams, Team Effectiveness, Team Learning Behaviour

The Effect of Team Learning Behaviours on Team Effectiveness in Virtual Teams

With the advent of the Internet and continuing advances in global communications (Priem, Li, & Carr, 2012), coupled with the trend of organisations using teams as work (Mathieu, Maynard, Rapp, & Gilson, 2008), virtual teams have become a reality. Organisations are seeing virtual teams as a solution to their business goals such as cutting costs, attracting a talent from a larger pool, improving productivity (Lipnack & Stamps, 2008). It increasingly makes more sense for organisations to have a virtual team distributed over various locations than to have a co-located one (Zakaria, Amelinckx, & Wilemon, 2004) as globalisation continues to trend.

A 2012 survey by the Society for Human Resource Management indicated that 46% of organisations based in the United States and specifically 66% of the large multinational organisations use some form of virtual teams (Alexandra, 2012; Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015). These numbers are expected to grow as more companies are preparing to use virtual teams in the future (Perry, 2008).

Companies may even be forced to use virtual teams due to externals factors. One example is the aftermath of the 2011 Christchurch, New Zealand earthquakes. Due to widespread structural damage, many office-based work teams, including government officials, were unable to return to their previous workplaces and offices. Due to safety concerns, this displacement continued even after the state of emergency was lifted. This led to many companies and local government offices putting in place flexible work arrangements such as working from home or ‘hotdesking’ (i.e. a shared desk arrangement). This move essentially created virtual teams on the spot without the usual training and planning that typically goes into their creation. Donnelly and Proctor-Thomson (2013) tracked displaced Inland Revenue staff members for over a year, from just after the earthquakes till when they finally returned to

a regular office environment. Before they returned to an office environment, staff members worked at different levels of virtuality. Although teams in the study described difficulties in transitioning to flexible work arrangements, they reported no adverse lost in productivity and even found work-life balance to be better.

In another example along the same lines, the Singapore government has been encouraging companies to put in place work from home initiatives (Ministry of Manpower, 2011). The rationale behind this being work from home as a pre-emptive backup plan to ensure business continuity in case of emergencies (as in the Christchurch earthquake example), for business related benefits such as reduced cost, and to generally increase the work-life balance of the populace.

From the above, it would seem that there is a growing trend of using virtual teams. This serves as the impetus for the present study. The present study attempts to study the relationship between team learning behaviour and team effectiveness in the context of team virtuality, as few studies have looked at this connection (Gilson et al., 2015). The present study also aims to be an updated study in light of the changing work contexts, namely, multiple computer-mediated communication technology advancements over the years (Suh, Shin, Ahuja, & Kim, 2011) and increasing worker's exposure and acceptance of said technology (Venkatesh & Davis, 2000).

Defining a Virtual Team. A virtual team is an umbrella term to refer to any team that fully or partially use information systems, via the Internet, as a platform on which to connect and work with each other (Gibson & Cohen, 2003). A virtual team whose members are spread out over different geographical locations and cultures is known as a distributed team. Taken to the extreme, a distributed team whose members are allowed to work from any location of their

choosing is known as a fully distributed team. Also, a single team member who works in a location geographically away from the rest of the team is known as a remote worker (Rodina, Zeimpekis, & Fouskas, 2003).

Traditionally, the opposite of a virtual team would be a co-located team, whereby all the team members would work in the same office, and communicate face-to-face. However, with the continuing advances in computer-mediated communication, even teams co-located in the same office can communicate using computer-mediated communication instead of face-to-face. As such, research has shifted its focus from comparing virtual teams with co-located teams to measuring the 'virtuality' of teams (Gilson et al., 2015). Accordingly, the present study will consider all work teams to have some virtuality, and take into account the level of their virtuality (Kirkman, Cordery, Mathieu, Rosen, & Kukenberger, 2013). Virtuality as a construct and its measures will be discussed later on.

The Debate over Virtual Teams. There is still a debate on whether virtuality is positively or negatively related to team outputs such as team effectiveness, team satisfaction and quality of decisions (Gilson et al., 2015). On one hand, studies such as Schweitzer and Duxbury (2010) found that working in virtual teams can have a negative impact on and team performance. On the other hand, studies such as Maynard, Mathieu, Rapp, and Gilson (2012) found that virtuality had a positive effect on team effectiveness.

To illustrate the debate, consider the argument for geographic dispersion of a virtual team. Cramton and Webber (2005) found that geographical distance as a measure of virtuality negatively correlated with team processes and effectiveness. This is directly at odds with Chudoba, Wynn, Lu, and Watson‐Manheim (2005), which found that geographical distance had no effect on team effectiveness. Considering that as both papers were written during a

similar time period when computer-mediated communication technologies were similar, and that both papers studied work teams in a single technology-related company, the difference in their conclusions is striking.

The side of the debate against virtual teams is mostly grounded in planning, team cultures, and coordination activities. An observational study found that regardless of the use of computer-mediated communications, the difficulty of team virtuality lies in the differences of context, culture and language between team members (J. S. Olson, Teasley, Covi, & Olson, 2002). These differences lead to trust issues that teams had to spend extra time and effort to overcome before productive work could continue, thus losing out in terms of overall effectiveness. For similar reasons, developing a group culture and integrating virtual teams are significant challenges to organisations (Mark, 2001).

A comparable study found that activities such as task and knowledge coordination were essential to effective virtual teams, but that such coordination activities took a relatively longer time to develop because of the time needed to form trust and normalise coordination activities (Kanawattanachai & Yoo, 2007). This is support by Peñarroja, Orengo, Zornoza, and Hernández (2013), as their study found similar results regarding coordination and trust. Likewise, Kock and Lynn (2012) found that although task complexity negatively affected team effectiveness possibly due to expending effort in added task complexity coping activities, with the proper coordination activities, this negative relationship can be overcome. Which seems to suggest that although teams can be similarly virtual, the difference of their practices can ‘make or break’ a virtual team (Carlile, 2002).

The above studies all seem to indicate that a prerequisite to an effective virtual team is various coordination activities, but that time and effort spent on these activities could potentially outweigh the benefits (Martins, Gilson, & Maynard, 2004; Mathieu et al., 2008).

The other side of the debate for virtual teams usually cites the unique benefits of virtual teams, trends such as the improved computer-mediated communications, and the ubiquity of the Internet.

Some studies indicate that virtual teams could have unique advantages over face-to-face teams. Studies such as Martínez-Moreno, González-Navarro, Zornoza, and Ripoll (2009) found that video conferencing virtual teams slightly outperformed face-to-face teams. Their study speculated that this was due to the high media richness of video conferencing. With subtle communication cues, such as eye contact, being present both in face-to-face and video conferencing, the two were similar enough to have a similar effect. Alternatively, it could be that because virtual teams had more time to discuss and make decisions than face-to-face teams, their decision quality was better, having had more time to come up with better solutions (Pridmore & Phillips-Wren, 2011). Meanwhile, Lowry, Roberts, Romano Jr, Cheney, and Hightower (2006) found that due to the high usage of computer-mediated communications in virtual teams, virtual teams could accommodate a larger team size than face-to-face teams. This was due to the inherently quicker and easier way it is to communicate to more people simultaneously via computer-mediated communication (e.g. Internet-based conference call).

Much of the previous research been conducted on how to overcome computer-mediated communication as a barrier, but not studying the theory that over the years, white-collar workers have become more used to computer-mediated communication technology (Marangunić & Granić, 2015). The technology acceptance model (Venkatesh & Davis, 2000) points out that the more people are positively exposed to technology, the more effective they will be at using said technology. This is true regardless of age; anyone how is sufficiently exposed to technology will be better at using it (Holzinger, Searle, & Wernbacher, 2011). To date, workers have had over 20 years to be exposed to computer-mediated communication since the Internet began in 1991 (Hauben & Hauben, 1998). This is over 10 years more

exposure than older studies such as Mark (2001) which found multiple challenges for teams to get used to working together over computer-mediated communication. Based on the technology acceptance model, it can be postulated that, with more years of technology exposure, the workers of today have a better grasp of computer-mediated communication. As such, the present study finds it important to take these factors into account when studying virtual teams and their effectiveness.

Lastly, improvements to in computer-mediated communications and the current ubiquity of the Internet could have made virtual teams more effective over recent years (Gilson et al., 2015). The topic of computer-mediated communications alone merits its own subsection.

Communication Technology and Virtual Teams. Communication technology forms the basis of how virtual teams can interact and work together. Consequently, it is considered as an important input by many past studies (Hertel, Geister, & Konradt, 2005). When Gibson and Cohen (2003) first wrote their book as a guide for virtual teams, computer-mediated communications were limited to early asynchronous forms of computer-mediated communications, such as email and phone calls. Asynchronous computer-mediated communications are forms of communication where not all team members were synchronised and had the most updated information as it became available. Over the past one and a half decades since the book by Gibson and Cohen (2003), there are now multiple synchronous forms of computer-mediated communications to choose from, including chatting apps and video conferencing (Gilson et al., 2015). Synchronous computer-mediated communications are technology where all team members are in sync with the most updated information (Malhotra, Majchrzak, & Rosen, 2007; Paul, Seetharaman, Samarah, & Mykytyn, 2004). It should be noted that synchronous computer-mediated communications generally have been found to have

higher media richness and effectiveness in the workplace (Ioannou-Georgiou, 1999; Paul et al., 2004).

Early research was polarised in their findings as to whether computer-mediated communications reduced virtual team performance (Schweitzer & Duxbury, 2010), or had no effect on virtual team performance (Han, Hiltz, Fjermestad, & Wang, 2011). However, these studies and many others focused on asynchronous computer-mediated communications rather than on newer synchronous computer-mediated communications which were increasingly being adopted by organisations (Gilson et al., 2015). If computer-mediated communications in the past were a barrier to virtual teams due to low media richness (Bryant, Albring, & Murthy, 2009), the more recent synchronous computer-mediated communication may be less of an issue given their high media richness (Gilson et al., 2015; Paul et al., 2004) and intra-group benefits (Suh et al., 2011), and thus, may not impede team effectiveness.

Furthermore, computer-mediated communications are also getting more accessible, increasing their adoption rate. So commonplace are computer-mediated communications that some companies have done away with traditional office spaces, and have all staff members working together via computer-mediated communications as remote workers (Shin, 2016). These aforementioned fully distributed teams rely wholly on computer-mediated communications for everyday business functions. Some of these companies have turned into evangelists for fully distributed teams and other virtual team related business practices, spouting the numerous business advantages it brings (Leung, 2017). It should be noted that not all companies can operate this way due to business constraints, such as factory machine operations, and that typically fully distributed teams are technology and Internet-related companies.

The above phenomenon of fully distributed teams and increasing adoption of virtual teams have spawned a totally new category of synchronous computer-mediated communications, known as collaboration tools. Collaboration tools move beyond a basic communication function and are typically software or applications (apps) that allow team members to work together on a piece of documentation or to build software in real time via the Internet. These tools include document sharing tools (e.g. Dropbox, Sharepoint), document co-creation tools (e.g. Google Docs), meeting tools (e.g. GoToMeeting, Google Hangouts), customer/team live chatting apps (e.g. Slack, RocketChat), project management tools (e.g. Basecamp, Blossom), social networking (e.g. Yammer, Jive), or a combination of these tools (e.g. Github). Furthermore, the main business goal of the companies that created and provide these tools is solely to meet the needs of virtual teams. Thus, there is a vested interest that these tools function well and are continually upgraded. Another new type of computer-mediated communication, which has overlap with collaboration tools, is social media. Team members can use social media for socialising with colleagues, asking for expertise and also for collaboration (Culnan, McHugh, & Zubillaga, 2010). These newer collaboration tools and social media have not received much attention from research (Gilson et al., 2015). Thus, it is not fully known what kind of an impact they could have on team effectiveness.

The above changing context of computer-mediated communication technology has not been fully captured by recent virtuality research. The present study seeks to do an up-to-date replication of previous studies in virtual team effectiveness with these changing contexts in mind

The role of shared understanding. As teams bring together people of different experiences, values and knowledge, it is expected that team members working together will be more effective at solving problems than individuals. Groups of people can be counted on as a

source of knowledge construction, and this is possible due to (cognitive) team learning behaviours (Van den Bossche, Gijselaers, Segers, & Kirschner, 2006). Such activities include interactions, discussion and negotiations (Roschelle, 1992). Through these activities, a team can better understand each other and their goals. Team members can take initiatives actions without having to check on other team members because of a shared understanding of their work (Cohen & Bailey, 1997). In virtual teams, the team learning behaviours activities take place through a medium that is fully or partially virtual (Pangil & Moi Chan, 2014).

Past research into virtual teams has not focused on the linkage between team learning behaviour and team effectiveness (Martins et al., 2004). This is evidenced by the lack of said research papers reviewed in extensive virtual team literature reviews such as Gilson et al. (2015) and Ale Ebrahim, Ahmed, and Taha (2009). Alternatively stated, it is unknown how the factor of virtuality plays into the relationship between team learning behaviours and team effectiveness. The present study seeks to investigate this matter.

Workgroups researched. Another issue with past research was on who was studied. Gilson et al. (2015) estimate that about 44% of past studies on virtual teams used student teams. It further goes on to point out that real-world work teams are studied, there is a tendency to study only expert groups (e.g. software developers or information technology professionals). This practice raises two issues. First, though student teams can approximate real-life, they might miss-represent actual work teams (Peterson & Merunka, 2014). Whenever possible, it should be better to study actual work teams. Secondly, information and communication technology experts might not be a representative sample. Considering that they are well versed in computer-mediated communications, information and communication technology experts might perform better in virtual teams due to their expertise. In the same study setting, a non-

technology related white-collar worker (e.g. accountant) might respond differently than an information and communication technology expert. No doubt, some types of work, particularly white-collar office jobs, lend themselves easier to virtualisation (as opposed to a factory job for example). However, limiting the sampling to groups who are already likely to work virtually might skew the results in favour of virtual teams. It is in the present study's interest to keep the sampling to a wider group of office workers whose work theoretically could be done as part of a virtual team.

Virtuality as an Input or a Moderator. Among available research, there continues to be a lack of consistency in regarding virtuality as an input or moderator (Gilson et al., 2015). Team inputs primarily refer to key deterministic factors that make up or are applied to a team. Examples of inputs are team design, team leadership styles, and team composition and diversity (Dulebohn & Hoch, 2017; Kozlowski & Bell, 2003). Moderators are the internal or external factors that moderate the input to process, or process to output, relationships. Examples of these include task interdependence and task complexity (Hambrick, Humphrey, & Gupta, 2015). To illustrate the variation in previous research, Bryant et al. (2009) found that virtuality as an input reduced social loafing, in contrast, Joshi, Lazarova, and Liao (2009) found that virtuality as moderator positively moderated the relationships of inspirational leadership to commitment, and trust. The present study also seeks to use virtuality as both an input and a moderator to help clarify which category virtuality should be in.

Constructs in the present study

Team Effectiveness. The main dependent variable of the present study is team effectiveness (team effectiveness). team effectiveness is defined as a team's capacity to

accomplish objectives set by an organisation or authority figure (Aubé & Rousseau, 2011). According to Hackman (1990), team effectiveness is measured as a combination of three factors: the degree of a team's productive output based on quantitative and qualitative standards, the degree to which the work enhances the capability of team members to work together interdependently in the future, and the degree to which team experience contributes to personal growth and wellbeing of the team members. These three factors, or sub-constructs, can be simply referred to as team performance, team viability, and team learning (Van den Bossche et al., 2006). This definition and its related measurement method are known as the "Hackman model."

As the standardised measure of team effectiveness, the present study will use the "Hackman model" as it is widely used and has been proven multiple times to be reliable and valid (Fried & Ferris, 1987; Schweitzer & Duxbury, 2010). This fits the goal of having the ability to easily compare the results of the present study with other studies (i.e. its comparability). Furthermore, the present study uses four different measures of team effectiveness and its sub-constructs based on the "Hackman model." This was done to maximise coverage of the differing definitions and measures of team effectiveness and to increase the present study's comparability. These four measures are namely, *general team effectiveness*, *team performance errors*, *team performance*, and *team viability*.

Team Learning Behaviours. Team learning behaviour can be defined as the process in which a team learns about their work-related tasks together. Team learning behaviour also can be thought of as the culmination of three processes. First is the construction of meaning, the act of team members speaking and attempting to understand each other (Stahl, 2000); secondly, co-construction of meaning, the act of team members refining and building on the

ideas currently put forth (Baker, 1994); thirdly, constructive conflict, the arguments and negotiations that lead to a final agreed-upon understanding of the team's task (Roschelle, 1992).

According to past studies, such as Edmondson (1999) and (Van den Bossche et al., 2006), a higher level of team learning behaviour should correlate with a higher level of team effectiveness and its sub-constructs. Thus, based on past studies, the present study will seek to reconfirm the known relationship of team learning behaviour to team effectiveness.

H1: Higher levels of team learning behaviours will be associated with to higher team effectiveness

Team virtuality. Team virtuality, or simply virtuality, is widely accepted to be the geographical dispersion and technology usage of team members (Gibson & Cohen, 2003). However, the present study believes that this is inadequate to measure the ever-changing landscape of virtual teams in the workplace. A measure of virtuality should be specific enough to measure virtual team work practices but general enough to not be out-dated when new technology arrives. The present study's measure of virtuality is adapted from Chudoba et al. (2005). The measure is defined here as groups of discontinuities that characterise and make up aspects of a virtual team environment. This measure was chosen as it meets the criteria set above, and also presents certain unique measures. According to Chudoba et al. (2005), the different aspects of virtuality did not load onto one single factor and were treated as separate measures of virtuality. The three factors it shortlisted are as follows.

Team distribution. Team distribution is the degree to which team members are distributed over different geographies and time zones, and relying on computer-mediated communications to work together. As mentioned before, this is the most common measure of virtuality (Gibson & Cohen, 2003). Thus, its inclusion as a measure of virtuality is particularly important for comparability.

Workplace mobility. Workplace mobility is the degree to which team members work in locations and environments other than a regular office space. These include working from home or working while travelling in places such as hotels or airports. As the examples found earlier suggest, workplace mobility is increasingly being utilised by organisations. Thus, to keep the present study relevant to current practices, workplace mobility is an important inclusion.

Variety of practices. Variety of practices is the degree to which team members experience cultural and work process diversity on their teams. That is to say, a team can be virtual, but its team members can be virtual in different ways. For example, different team members can access computer-mediated communication tools differently. This is an interesting concept that is not widely looked at. Many of past studies have looked at virtuality as if all organisation and team member applied virtuality in the same way. In practice, this might not be the case, and minute differences in variety of practices may result in differences in team outputs. Thus, variety of practices is a noteworthy inclusion.

As mentioned previously, virtuality could be either a team input or a mediator. To resolve this, the present study has decided to treat them as both. The present study will investigate how team virtuality as an input affects team effectiveness. This will be a re-examination of the relationship first put out by past studies such as Chudoba et al. (2005) and

Kock and Lynn (2012). It is the aim of the present study to shed some light on the aforementioned on-going debate for and against virtual teams.

R1: How does the level of team virtuality (including team distribution, workplace mobility, and variety of practices) relate to the different dimensions of team effectiveness?

In terms of virtuality being a moderator, virtuality can mediate a process to output relationship. The idea here is to explore how else virtuality might affect virtual teams and their effectiveness. Alternatively stated, if virtual teams are more/less effective than face-to-face teams, what are some possible reasons for this difference? How does virtuality make a virtual team better/worse? In this case, the present study looks at the relationship between team learning behaviour and team effectiveness, and how virtuality might moderate it.

R2: How does the level of team virtuality (including team distribution, workplace mobility, and variety of practices) moderate the relationship between team learning behaviours and the different dimensions of team effectiveness?

Figure 1 represents the research model based on the hypothesis (H1), and the two research questions (R1 and R2). For ease of reference and understanding here, the multiple relationships between the sub-constructs of virtuality and team effectiveness have been simplified. However, when looking at the methods and results, each possible individual relationship between sub-constructs will be examined.

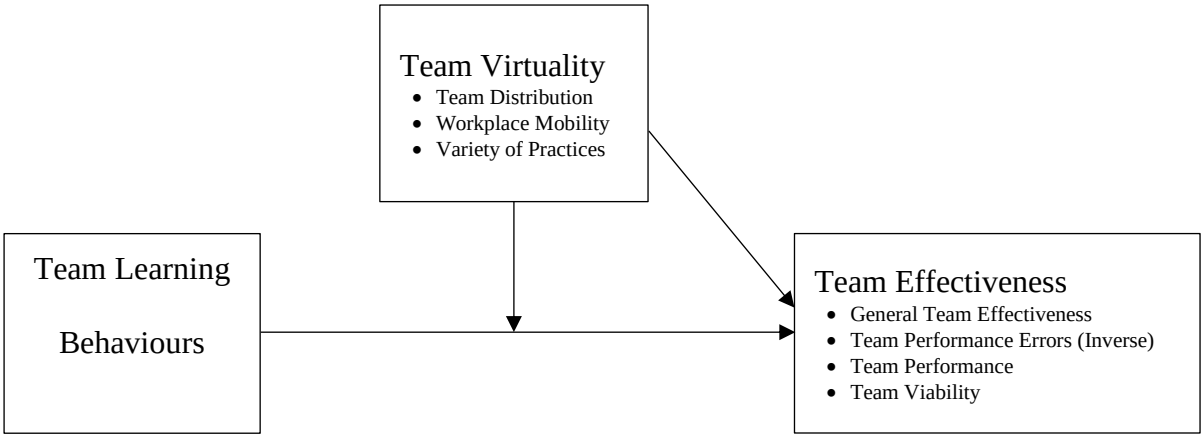

Figure 1 - The general research model for the present study

Method

Procedures

Participants were recruited through various channels over the Internet during a four-month period. Multiple companies were emailed to ask if their work teams could participate in the present study. Advertisements to participate in the present study were also posted to multiple message boards (see Appendix A for advertisement). Participation was voluntary and each participant was to receive a technical report of the present study's results. Once participants expressed interest, they were emailed an anonymous questionnaire hyperlink.

The participants were screened out to be white-collar workers employed in a full-time or part-time capacity, who worked in a team. This is important so as not to sample participants whose work are difficult to 'digitise', such as blue-collar workers whose work is linked to a physical location. However, participants were not distinguished between information and communication technology experts and non-technological experts/workers. This is in line with

the goal of the present study to investigate the effects of virtuality on non-technological workers.

A questionnaire is the main method of instrumentation for the present study. The present study's questionnaire was available to be completed online on the Qualtrics® platform. Participants were directed to the questionnaire (see Appendix B for a list of questions) via an online link. Participants were free to complete the questionnaire on their own time, without time limits. The questionnaire contained constant reminders for the participants to answer based on a work team context.

Participants

From the original n = 99 participants, empty responses were removed to arrive at a final n = 75 participant. Data was collected from these 75 participants (36 males, 38 females, and 1 'gender diverse'). The age range was 22 to 64 years old, with the mean age of participants being 35.71 years old (*SD* = 11.6), indicative of a younger participant pool.

Due to the virtual and global nature of the present study, participants came from multiple countries. The countries are, in order of participant numbers are, Singapore (*n* = 29), the United States of America (*n* = 18), New Zealand (*n* = 14), Australia (*n* = 3), followed by Bulgaria, Canada, Colombia, Hong Kong, Japan, Peru, South Africa, Switzerland, the United Kingdom, and the United Arab Emirates with one participant each.

To check if indeed participants were office workers with the potential to have their work made virtual, participants were asked the degree of frequency that their work could be done digitally. Out of a score of seven, the participants mostly indicated that their work was digitisable (*M* = 6.09, *SD* = 1.27).

Measures

In order to maintain the highest standard of reliability, validity, and the ability to compare the results of the present study with past studies, all the items and scales used in the present study's questionnaire were taken or adapted from validated questionnaires of past studies. The full list of all relevant items used in the questionnaire can be found in Appendix B. Unless otherwise stated, all the items below were measured with a 7-point Likert-type response scale, from 1 = "Disagree" to 7 = "Agree," and the composite score for each construct was calculated by taking the mean of its items.

Team effectiveness. Team effectiveness has been assessed by four measures.

General team effectiveness. The first of the team effectiveness measures is taken from Van den Bossche et al. (2006). This measure functions as the most general measure of team effectiveness that the present study has because it follows most closely to the "Hackman model" of team effectiveness, one of the most widely used models of team effectiveness (Cohen & Bailey, 1997; Edmondson, 1999). This measure of team effectiveness can also be called 'general team effectiveness' and the composite score includes all the three sub-constructs.

An example of an item is, "This team has completed tasks in a way we all agree upon". A higher general team effectiveness score indicates that a team generally has better performance, is better to work together in the future, and is better able to learn from its experiences. The internal consistency of the items was $\alpha = .91$.

Team performance errors. Team performance errors is a 'negative' sub-construct of team performance. As the second of the team effectiveness measures, it is taken from Edmondson (1999). It was chosen as it is a widely cited landmark study in team's research that effectively measured team performance (Argote, McEvily, & Reagans, 2003; Mathieu et al.,

2008). Although the original study had separate participant rating and observer rating sections, only the participant rating section was adapted. Also, although the original scale was meant to measure team effectiveness as a whole, the present study finds that the scale measured mistakes more than it measured performance. Thus, the present study will invert this sub-construct into a negative form and label it team performance errors.

An example of an item is, "Recently this team seems to be "slipping" in its level of performance and accomplishments". A higher team performance error score indicates that a team made more mistakes in their work, thus leading to lower team performance. The internal consistency of the items was $\alpha = .78$.

Team performance. Team performance is the degree a team's output meets its pre-set requirements. Being the third of the team effectiveness measures, it is taken from Chudoba et al. (2005). In terms of study comparability, it is important to include team performance because most research into virtual teams will use team performance as a dependent variable (Gibson & Cohen, 2003; Gilson et al., 2015; Schweitzer & Duxbury, 2010).

An example of an item is, "The quality of this team's deliverables is excellent". A higher team performance score indicates that a team produced better quality work and on time. For these items, a 7-point Likert-type response scale, from 1 = "Never" to 7 = "All the Time," was used. The internal consistency of the items is $\alpha = .61$.

Team viability. Team viability can be defined as the degree to which the current team improves its members' ability to work as a team in the future. Being the fourth of the team effectiveness measures, it is again adapted from Chudoba et al. (2005).

An example of an item is, "There was not enough trust among team members". A higher team viability score indicates that a team is better at working together and will likely do so in

the future. For these items, a 7-point Likert-type response scale, from 1 = "Never" to 7 = "All the Time," was used. The internal consistency of the items is α = .85.

Team learning behaviours. The present study's definition of team learning behaviours refers to the interactions between team members towards a shared understanding of work tasks and processes (Roschelle, 1992; Van den Bossche et al., 2006). The present study found that team learning behaviours best measured with a seven-item questionnaire taken from Edmondson (1999) for two reasons. Firstly, as stated above, it was a widely used study (Argote et al., 2003; Mathieu et al., 2008). Secondly, this source tested the relationship between team learning behaviour and team performance (a sub-construct of team effectiveness) with a result of $B = .80$ at $p < .01$. This is a past result that the present study can aim to replicate.

An example of an item is, "This team regularly takes time to figure out ways to improve the team's work processes". A higher team learning behaviour score indicates that a team exhibits the behaviours of discussing the nature of their work and debating the possible solutions to their tasks. The internal consistency of the items is α = .79.

Team Virtuality. The present study used a scale that was developed specifically for the purpose of measuring team virtuality. The virtuality scale developed, refined and tested by Chudoba et al. (2005) was created for the specific purpose of standardising the measure of how virtual an organisation can be. It was designed to assess virtual teams from a more holistic perspective, such as measuring the differences in technology and difference in work practices, and not only the geographical and cultural differences.

The team virtuality scale adapted for the present study featured a set of 12 items similar to the original. The items were modified to suit the team-based nature of the present study and

also to clarify the context. Confirmatory factor analysis with oblimin rotation was used on these 12 items. The items loaded onto three separate dimensions of the main construct of team virtuality, these are team distribution, workplace mobility, and variety of practices. The three dimensions and how the items loaded on them are the same as the original study that this measure was adapted from. All the 12 items were measured on a 6-point Likert-type frequency scale, ranging from, 1 = "Never," 2 = "At least once a year," 3 = "Quarterly," 4 = "Monthly," 5 = "Weekly," and 6 = "Daily."

Team distribution. Team distribution is the degree to which work team members are distributed over differing time zones and geography. An example of such an item is, "How often do you collaborate with team members in different time zones", and the four items under this dimension have an internal consistency of $\alpha = .83$. The composite score was calculated by taking the average of the reliable items. A higher team distribution score indicates that a team is more dispersed over distance and time zones.

Workplace mobility. Workplace mobility is the degree to which team members work in settings and environments different from a regular office environment. This includes working from home, in a client's office or in an office that is not their 'main' one. An example of such an item is, "How often do you work at home during normal business days", and the five items under this dimension have an internal consistency of $\alpha = .76$. The composite score was calculated by taking the average of the reliable items. A higher workplace mobility score indicates that team members work from unique locations or travel a lot more from said locations.

Variety of practices. Variety of practices is the degree to which teams differ in cultural and work processes. An example of such an item is, "How often do you work with team members that use different collaboration technologies", and the three items under this

dimension have an internal consistency of α = .71. The composite score was calculated by taking the average of the reliable items. A higher variety of practices score indicates that team members have a greater difference in their technology-based working styles and technology that they use.

Data Analysis

In order to test for the various H1, R1 and R2, moderated regression analysis was used. Predictors were centred, and interaction terms created by multiplying the centred predictor variables with the centred moderator variables. The predictors and the moderators were entered in Step 1, and the interaction terms in Step 2.

Results

Correlations are presented in Table 1 provides the results for the descriptive statistics and intercorrelations for the main constructs.

Table 1

Main Variable and their Descriptive Statistics, Pearson Correlations and α values

	Mean	SD	1	2	3	4	5	6	7	8
1. Team Learning Behaviours	4.86	1.29	.79							
2. General Team Effectiveness	5.18	1.39	.70**	.91						
3. Team Performance Errors	2.93	1.20	-.38**	-.56**	.78					
4. Team Performance	5.13	0.87	.34**	.44**	-.55**	.61				
5. Team Viability	5.01	0.97	.55**	.75**	-.65**	.49**	.85			
6. Team Virtuality (Team Distribution)	3.16	1.62	.28*	.22	-.04	-.07	.18	.83		
7. Team Virtuality (Workplace Mobility)	3.72	1.30	.32**	.27*	-.30**	.20	.26*	.48**	.76	
8. Team Virtuality (Variety of Practices)	3.58	1.38	.38**	.35**	-.13	.15	.23	.42**	.35**	.71

** $p < .01$, * $p < .05$

In reference to H1, proposing that team learning behaviours are positively related to team effectiveness, Table 2 and 3 present the relationships between team learning behaviour and the four team effectiveness measures. Thus, the present study found support for H1, namely, team learning behaviours were positively related to general team effectiveness (B = 0.65, SE = 0.11, $p < .01$); team learning behaviours were negatively related to team performance errors (B = -0.40, SE = 0.13, $p < .01$); team learning behaviours to team performance (B = 0.24, SE = 0.09, $p < .01$); team learning behaviours were positively related to team viability (B = 0.37, SE = 0.10, $p < .01$). Note that team learning behaviour has a negative relationship with team performance errors, as team performance errors is the inverse of team performance.

In reference to R1, investigating the relationship between team virtuality and team effectiveness, the results in Table 2 and 3 show that only two out of the possible 12 relationships, between virtuality and team effectiveness, were significant. Workplace mobility was significantly negatively related to team performance errors (B = -.26, SE = .12, p = .037), but team distribution was significantly negatively related to team performance (B = -.20, SE = .07, $p < .01$).

Table 2

Regression coefficients (unstandardized) for the hierarchical moderated regression analysis of General Team Effectiveness and Team Performance Errors

Variable	General Team Effectiveness					Team Performance Errors				
	B	SE	p	Low CI	High CI	B	SE	p	Low CI	High CI
Step 1										
Team Learning Behaviours	0.69	0.10	.00	0.48	0.90	-0.32	0.11	.01	-0.54	-0.09
Team Distribution	-0.02	0.09	.79	-0.20	0.15	0.14	0.10	.17	-0.06	0.33
Workplace Mobility	0.04	0.11	.71	-0.18	0.26	-0.27	0.12	.03	-0.50	-0.03
Variety of Practices	0.10	0.10	.32	-0.10	0.30	0.02	0.11	.84	-0.20	0.24
Adjusted R^2	.46					.15				
Step 2										
Team Learning Behaviours	0.65	0.11	.00**	0.42	0.88	-0.40	0.13	.00**	-0.65	-0.15
Team Distribution	-0.04	0.09	.63	-0.22	0.14	0.18	0.10	.08	-0.02	0.38
Workplace Mobility	0.02	0.11	.87	-0.20	0.24	-0.26	0.12	.04*	-0.50	-0.02
Variety of Practices	0.12	0.10	.24	-0.08	0.32	0.00	0.11	.97	-0.22	0.22
Team Learning Behaviours × Team Distribution	0.09	0.08	.25	-0.06	0.24	-0.08	0.08	.34	-0.24	0.09
Team Learning Behaviours × Workplace Mobility	0.02	0.10	.87	-0.19	0.22	-0.05	0.11	.66	-0.27	0.17
Team Learning Behaviours × Variety of Practices	-0.15	0.08	.06^	-0.30	0.01	-0.05	0.08	.52	-0.22	0.11
Adjusted R^2	.47					.17				
Adjusted R^2 change	.01					.01				

*** p <.01, * p <.05, ^ p <.1*

Table 3

Regression coefficients (unstandardized) for the hierarchical moderated regression analysis of Team Performance and Team Viability

Variable	Team Performance					Team Viability				
	B	SE	p	Low CI	High CI	B	SE	p	Low CI	High CI
Step 1										
Team Learning Behaviours	0.18	0.08	.03	0.02	0.35	0.38	0.09	.00	0.21	0.56
Team Distribution	-0.15	0.07	.03	-0.29	-0.01	-0.01	0.07	.90	-0.16	0.14
Workplace Mobility	0.15	0.09	.09	-0.03	0.32	0.07	0.09	.40	-0.10	0.26
Variety of Practices	0.05	0.08	.51	-0.11	0.21	0.01	0.09	.93	-0.16	0.18
Adjusted R^2	.11					.26				
Step 2										
Team Learning Behaviours	0.24	0.09	.01**	0.07	0.42	0.37	0.10	.00**	0.18	0.56
Team Distribution	-0.20	0.07	.01**	-0.34	-0.06	-0.02	0.08	.80	-0.17	0.13
Workplace Mobility	0.13	0.09	.15	-0.05	0.30	0.04	0.09	.65	-0.14	0.23
Variety of Practices	0.08	0.08	.31	-0.08	0.24	0.03	0.09	.76	-0.14	0.20
Team Learning Behaviours × Team Distribution	0.11	0.06	.06^	-0.01	0.23	0.04	0.06	.57	-0.09	0.16
Team Learning Behaviours × Workplace Mobility	0.07	0.08	.37	-0.09	0.23	0.08	0.09	.38	-0.10	0.25
Team Learning Behaviours × Variety of Practices	-0.04	0.06	.54	-0.16	0.08	-0.13	0.06	.05^	-0.25	0.00
Adjusted R^2	.18					.27				
Adjusted R^2 change	.07					.01				

*** p <.01, * p <.05, ^ p <.1*

In reference to R2, investigating the moderating relationship of team virtuality on the relationship between team learning behaviour and team effectiveness, the criterion used to determine a significant moderation effect is $p < .1$ and adjusted R^2 change >.01. The reason for the cut-off at a p-value of .1, as opposed to the regular p-value of .05, is so that the power of the interaction term can be increased with a more liberal level of significance. The reason for the R^2 change value is to make sure that there is more than 1% of variance explained by the interaction terms (Dawson, 2014). Using this criterion, 3 moderation effects were identified. These have been plotted below.

Figure 2 presents the two-way interaction of the effect of team learning behaviour on general team effectiveness, as moderated by variety of practices.

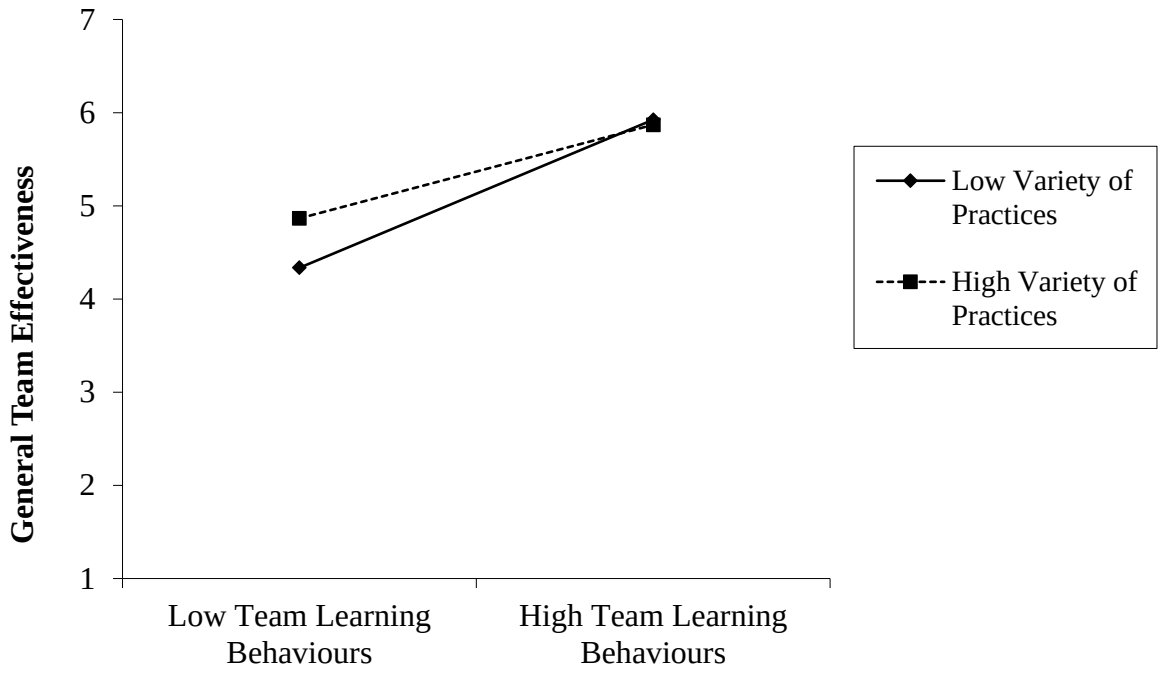

Figure 2 - Two-way factorial graph of the relationship of team learning behaviour to general team effectiveness as moderated by variety of practice

In Figure 2, overall, high variety of practices teams had higher general team effectiveness than low variety of practices teams. This main effect is also qualified by an interaction of team learning behaviour and variety of practices. The relationship between team learning behaviours and general team effectiveness was positive regardless of variety of practice, but the relationship was stronger among those with low variety of practices, as compared to those with high variety of practices.

Figure 3 represents a two-way interaction chart of the effect of team learning behaviour on team performance, as moderated by team distribution.

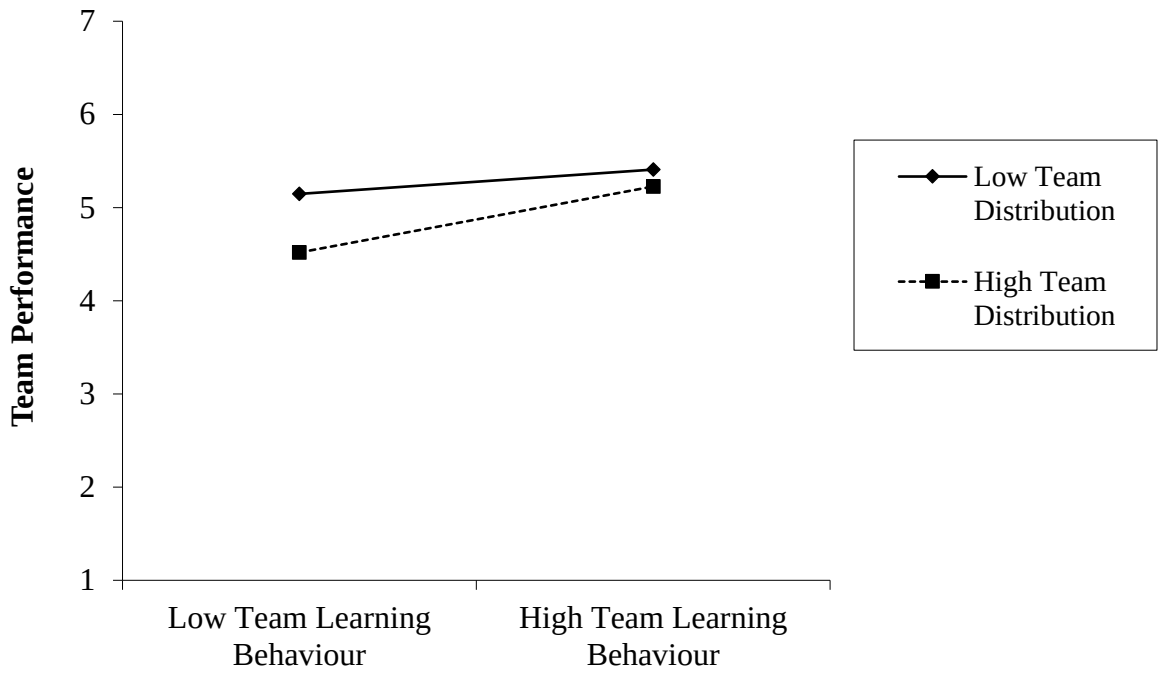

Figure 3 - Two-way factorial graph of the relationship of team learning behaviour to team performance as moderated by team distribution

In Figure 3, overall, teams with low team distribution performed better than highly distributed teams. This main effect was qualified by an interaction between team learning

behaviour and team distribution, in particular, teams with high distribution. The relationship between team learning behaviours and team performance was positive regardless of team distribution, but this relationship was stronger among those with high team distribution, as compared to those with low team distribution.

Figure 4 represents a two-way interaction chart of the effect of team learning behaviour on team viability, as moderated by variety of practices.

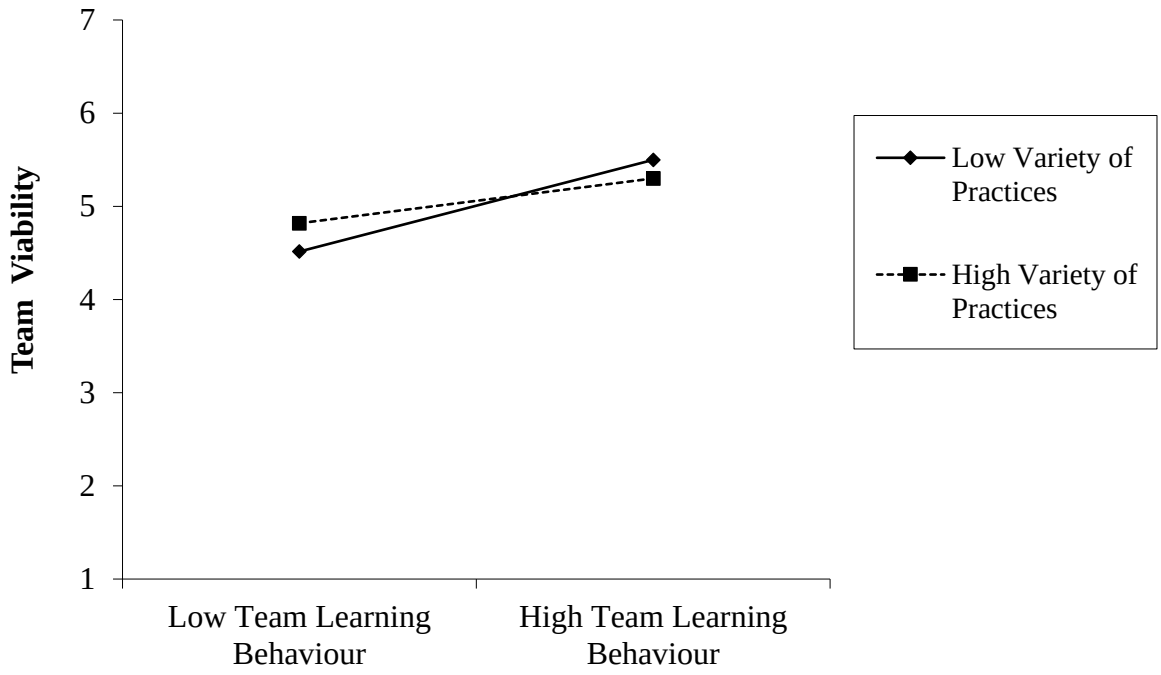

Figure 4 - Two-way factorial graph of the relationship of team learning behaviour to team viability as moderated by variety of practices

In Figure 4, overall, there is no discernible difference in team viability between high and low variety of practices teams. However, there is an interaction effect between team learning behaviour and variety of practices. The relationship between team learning behaviours and team viability was positive regardless of variety of practice, but the relationship was

stronger among those with low variety of practices, as compared to those with high variety of practices.

Discussion

The aim of the present study is to look at the effects of team virtuality with consideration given to recent advances in technology and work practices. Firstly, the present study sought to confirm the positive relationship between team learning behaviour and team effectiveness (H1). Secondly, to add in the factors of virtuality, the present study looked at how the factors of virtuality might affect team effectiveness directly (R1). Thirdly, the present study's unique contribution is looking for possible causes or reasons for virtuality's moderating effect on team effectiveness. To explore this, the present study studied the moderation effect of virtuality on the team learning behaviour to team effectiveness relationship (R2).

Interpretation of results. In reference to H1, proposing that team learning behaviours are positively related to team effectiveness, team learning behaviour was positively correlated with all tested aspects of team effectiveness. This is in line with past studies such as Van den Bossche et al. (2006), as the present study was re-testing the known relationship between the two. The present study was successful in confirming the positive relationship between team learning behaviour and team effectiveness based on the support for H1.

In reference to R1, investigating the relationship between team virtuality and team effectiveness, two direct relationships between team virtuality constructs and team effectiveness constructs were found. Firstly, workplace mobility has a significant negative relationship with team performance errors. This seems to indicate that more mobile teams make

fewer performance mistakes. Considering the debate on the use of virtual teams, this result shows support for the use of virtual teams. A possible reason for this result is that team members with high workplace mobility are able to choose their work environments. The logic being that if an individual's usual workplace or office environment not conducive to doing work (i.e., there are distractions that cause individuals to make mistakes at work), and given a choice, the individual can physically move to a location which is more conducive to work in (Ernst Kossek, Kalliath, & Kalliath, 2012).

Secondly, team distribution has a significant negative relationship with team performance. This indicates that widely distributed teams have lower team performance. This result shows support against the use of virtual teams. A reasoning for this result is that difficulties in differences of location context, time zones, societal culture and working culture would persist despite the use of computer-mediated communications (G. M. Olson & Olson, 2000). This reasoning is prevalent among relatively older virtual team research (Gibson & Cohen, 2003; Gilson et al., 2015).

However, it should be noted that this result was not found in the other forms of team effectiveness. Team distribution was not found to significantly related to general team effectiveness, nor team performance errors. This could mean that although team performance might suffer because of distance, overall team effectiveness remains unaffected by it. This is similar to Chudoba et al. (2005) found, whereby team distribution had no significant relationship with team effectiveness. Also, this is supportive of past research arguing for the use of virtual teams.

In reference to R2, investigating the moderating relationship of team virtuality on the relationship between team learning behaviour and team effectiveness, three of the 12 possible moderating relationships were found to be significant. These results lead to two themes.

The first theme, relates to the moderating effect of variety of practices. The present study found that a larger variety of practices was related to a weaker relationship between team learning behaviour and general team effectiveness. At the same time, the present study found that a larger variety of practice is also related to a weaker relationship team learning behaviour on team viability. Stated in the opposite perspective, this would indicate that teams with higher variety of practices will not benefit when team learning behaviour is increased. Thus, this observation indicates support against the use of virtual teams. The logic for this is that if high virtuality teams already take relatively more effort to coordinate and build up team learning activities (Kanawattanachai & Yoo, 2007; Mark, 2001; J. S. Olson et al., 2002), but the results of such activities may be more effective in teams with low virtuality, then the latter team is more cost-effective. One plausible explanation for this result is that in high variety of practices, team members are all using different methods of working and are harder to coordinate between. Thus, the act of engaging in team learning behaviours becomes less effective, in terms of increasing general team effectiveness and team viability.

This line of reasoning makes sense until the individual points on the chart are taken into account. In Figure 2, the highest point of general team effectiveness is shared by both high and low variety of practice teams with high team learning behaviour. This means that when team learning behaviours are high, variety of practices do not matter, but when team learning behaviours are low, different variety of practices relate to differences in general team effectiveness. This line of reasoning would indicate support for the use of virtual teams because high team learning behaviour can close the gap in general team effectiveness regardless of variety of practices.

The second theme, relates to the moderating effect of team distribution. Mentioned earlier, the present study found that on a whole, higher distribution teams performed worse than teams with a low distribution (as per R1). However, it was also found that a higher level

of team distribution was related to a stronger relationship between team learning behaviour and team performance. The results confound each other. High team distribution relates to lower team performance but relates to stronger team learning behaviour to team performance relationship. These results show support both for and against the use of virtual teams. A possible explanation for this result is that highly distributed teams, who work in different locations and who need more coordination than teams with low distribution (Kanawattanachai & Yoo, 2007), would view said coordination and team learning behaviours as a necessity for their team to function, and thus respond better to it.

Implications and comparisons with past research. A good past study to compare results with is Chudoba et al. (2005) because the present study's virtuality questionnaires are adapted from it. Firstly, it did not find team distribution to have a significant relationship on team performance. On the contrary, the present study found that team distribution had a significantly negative relationship with team performance (but had no significant relationship with general team effectiveness). Secondly, it also indicated that workplace mobility had a negative relationship with team performance, but this relationship was not found to be significant. On the contrary, the present study found support that workplace mobility significantly decreases team performance errors (the inverse of team performance). Thirdly, it found that variety of practices had a negative relationship on team performance. This result was not exactly replicated in this study. However, the present study did find that variety of practices negatively moderated the team learning behaviour to general team effectiveness and team viability relationships. It is unexpected that the present study contradicts a study it was based on in multiple ways. A plausible explanation for the contradiction is that the original study was conducted in 2005 when computer-mediated communications were not as advanced. Conversely, the present study was conducted in 2017, a difference of 12 years, whereby

computer-mediated communications have advanced at a high rate (Koutsabasis, Vosinakis, Malisova, & Paparounas, 2012). It also might be plausible that work practices regarding computer-mediated communications have changed over time. Based on these, the present study then becomes an interesting take on how teams have evolved fulfils the present study's interest in how relatively recent technology and attitudes in the workplace could influence virtuality and team effectiveness.

Following the logic of time differences, more recent studies should be used as comparisons. Carlson, Carlson, Hunter, Vaughn, and George (2017), a relatively recent study, is a good comparison as it is also a moderation-based study with team effectiveness as its dependent variable. Their study found that a team's level of experience with computer-mediated communications (as a measure of virtuality) was not directly related to team effectiveness. This mirrors the present study's findings that most virtuality measures did not have a significant direct relationship with team effectiveness. Next, it also found that "team effectiveness was higher if team members were willing to communicate in a more open manner", and that this effect was increased with more experience with computer-mediated communications (virtuality). This mirrors the present study's findings that team distribution positively moderates the relationship between team learning behaviour to team performance. It also clues in that more experience with computer-mediated communication can help virtual teams. These commonalities further strengthen the claim that current research provides support for the use of virtual teams due to the current level of computer-mediated communication technology.

The study by De Jong, Dirks, and Gillespie (2016), another meta-analysis, is a good comparison as it too is comparatively recent. Among its multiple hypotheses was on that measured virtuality's moderating effect on trust and team effectiveness. The authors hypothesised that with higher virtuality, the relationship of trust to team effectiveness would

be strengthened, possibly because teams would be more likely to accept the inherent uncertain of working with ‘unseen’ team members. In this case, trust can be seen as an approximation of team learning behaviour, as both require team members collaborating with each other. Ultimately, this hypothesis was not supported. This result contradicts the present study, which found three moderation relationships out of a possible twelve. Considering that the present study also found the remaining nine moderation relationships to be not supported, it could be that virtuality as a moderator is a misconstrued idea or that it only applies in specific conditions. Further research will be needed to fully determine this.

In contrast to an earlier finding in the present study that, in some contexts, increasing team learning behaviour could potentially close the gap in the difference in team effectiveness between high and low virtual teams, Andres (2012) suggests that this is easier said than done. It advises that increasing team learning behaviours was more difficult in virtual teams than in face-to-face teams as there was a higher chance of information lag and incoherent messages when using computer-mediated communications, thus leading to misunderstandings. This could explain the reason why past research has found high virtuality to be an issue for team effectiveness: computer-mediated communication technology in the past was not good enough to facilitate high team learning behaviour for virtual teams, thus leading to consistently low team learning behaviour and thus lower team effectiveness for virtual teams. This would mean that the fault lies more so in the technology than in the team or its practices. Still, the present study did show that high team learning behaviour in high virtuality teams is possible with current computer-mediated communication technology. Therefore, one can postulate that in the future as computer-mediated communications technology improves, information lag and incoherent messages using computer-mediated communications will be less and less of a problem, and thus, virtual teams could one day be indistinguishable from face-to-face teams in terms of effectiveness.

In summary, the present study is the first to show the effects of team learning behaviour on team effectiveness at different levels and aspects of virtuality. It was thought that since this study was conducted relatively recently, in an environment where synchronous computer-mediated communication is the readily available, it would produce results favourable to virtual teams. However, the results were varied, with each of the three aspects of virtuality producing contradicting or opposing results. First, workplace mobility was indicated to be advantageous to highly virtual teams. Second, variety of practice consistently appeared to be detrimental to highly virtual teams. Third, there was evidence that team distribution was detrimental to highly virtual teams via a direct effect on team effectiveness but advantageous via the moderation effect of the team learning behaviour to team performance relationship. Just like the ongoing debate in virtual research for and against the use of virtual teams, the present research provides no concrete evidence for one side of the argument. This sentiment is mirrored when the present study is compared with recent studies on virtual teams. Ultimately, it seems that virtuality cannot be taken together as one whole construct, but multiple parts that can be both advantageous and detrimental to highly virtual teams depending on the context.

Strengths and Limitations

Before making a final conclusion, the strengths and limitations of the present study and implications for future research should be addressed to give a more holistic view of the results.

Standard measurements in virtual team research. Much of early research into virtual teams was directly comparing virtual teams to face-to-face teams (Powell, Piccoli, & Ives, 2004). Only recently have studies begun to tag a level of virtuality to virtual teams (Gilson et al., 2015), similar to the concept that all work teams are virtual to varying degrees. Along

with this, the definition and measurement of team virtuality have also become more multidimensional. A consistent theme in these studies of virtuality are the measures of geographic dispersion and technology usage (Gibson & Cohen, 2003). However, there has yet to be a standardised or widely agreed upon measure of virtuality (Gilson et al., 2015; Schweitzer & Duxbury, 2010). Some studies will include member roles and relationship like in Gibson and Gibbs (2006), some add in the transitory nature of team structure like in Harvey, Novicevic, and Garrison (2005), and others measure it by the media richness of the computer-mediated communications used (Ganesh & Gupta, 2010). As such, the present study has overcome this issue by using a standardised measure of virtuality from Chudoba et al. (2005). Future research should use this scale as a common measurement, or one of the other valid scales as listed by Schweitzer and Duxbury (2010).

A related point along the same vein is team effectiveness not having a standardised measure (Mathieu et al., 2008). What exactly constitutes to team effectiveness, what are the criteria for measurement, how it is measured, and what are team effectiveness's sub-constructs vary from study to study. It should be noted that this is an issue not just in virtual team research but in general teams research too. Some studies measured their virtual team's team effectiveness mainly by objective team sales figures (Kock & Lynn, 2012). Others used virtual team managers to rate their virtual teams based on their perspective of how well the team performed (Maynard et al., 2012). All these different definitions of team effectiveness make it hard to form a unified understanding of the effects of virtuality and virtual teams on team outcomes (Gilson et al., 2015). Again, the present study used a more widely accepted model of team effectiveness, from Hackman (1990), thus making the results easier to compare among studies.

Study design. There are some study design limitations of the present study. Firstly, a common complaint of virtual team research is that the vast majority of it is cross-sectional and not longitudinal (Gilson et al., 2015). The present study is guilty of this too. Future research should replicate this study, or similar moderation effect studies and look for changes over time.

Secondly, compared with research in general, this study has a relatively small sample size. This has led to lower statistical power and limited representativeness. This was partially counteracted by using a more lenient criterion to search for significant moderating effects and sampling from an international pool of work team members of various occupations. Future research is needed in larger samples to determine the generalisability of the present study's results.

Thirdly, the present study only used individual participants as respondents and did not account for team membership. It is possible that team members of the participants would have a different view on their team's team learning behaviour and team effectiveness. Furthermore, the survey was based on respondents' perceptions of team effectiveness, not actual team effectiveness scores from a performance review or a third-party rater. Thus, it should be noted that all factors surveyed in this study are not absolute measures but measures of perception (e.g. perceived team performance). That said, other research, such as Edmondson (1999), have used perceived team effectiveness and found it similar enough to objective or third-party ratings of team effectiveness, supporting the validity of self-report measures.

Non-significant results. In reference to R1, 10 of 12 the possible relationships between the virtuality measures and aspects of team effectiveness were not found to be significant. In reference to R2, nine of 12 possible moderation effects of virtuality measures on the team learning behaviour to team effectiveness relationships were not found to be significant either.

This could signal a potential power issue given the relatively small sample. Alternatively, it could be that a virtuality does not have that much of an effect (both direct and in moderation) on team effectiveness. The way to know for sure is for future replication studies with similar conditions.

Measures of technology. Although the present study talked about capturing the current level of technological advancement in computer-mediated communications and its relationship to virtual team effectiveness, it did not measure the type of technology used by its participants. This is due to three reasons. Firstly, the ever-changing nature of the technology being used makes it hard to record, as even the same computer-mediated communication programme is updated and improved year by year. Secondly, the difficulty to match similar technology together due to the small but multiple differences in their functionality. Thirdly, (similar to the first reason) the difference and subtleties of synchronous and asynchronous communication technology (Branon & Essex, 2001), the various combinations of the two, and their various levels of media richness (Klitmøller & Lauring, 2013) were difficult to record and compare against each other. These factors were also beyond the scope of the present study. One possible solution to this limitation that future research can adopt is to use the date that the present study was conducted as a benchmark to indicate the available technology at the time compared with the technology available when future studies are conducted. Alternatively, future studies can look into a method of measuring and categorising the different computer-mediated communication options in the market.

Team reward system. The present study did not take into account the reward and performance system of its participant's teams. That is, there could have been a difference in

team performance between teams with individual performance rewards versus teams with team-based rewards (DeShon, Kozlowski, Schmidt, Milner, & Wiechmann, 2004). It would make sense that teams rewarded for working well together will have it in their interest to increase both team learning behaviour and team effectiveness. Measuring the reward system used was beyond the scope of the present study, but should be explored as a possible control factor in future research.

Conclusion and Future Research

As virtual teams become more and more an accepted and an almost necessary practice in today's increasingly globalised economy (Schaubroeck & Yu, 2017), the question should not be to debate whether high or low virtuality teams are 'better', but instead "what can make virtual teams more effective?". Which aspects of virtuality make virtual teams more or less effective? What different levels of the three aspects of virtuality can teams adopt in order to maximise overall team effectiveness? What steps should be taken to ensure team effectiveness and performance is not lost when transitioning from a low to high virtuality team? When organisations are hit with a physical crisis that makes face-to-face teams impossible, such as the earthquakes that devastated Christchurch, what can they do about it? How do employee's changing attitudes and exposure to technology affect virtual team effectiveness? The present study also serves a reminder that since computer-mediated communication technology enables virtual teams to exist, as the former has changed and evolved, so does the latter. Future research should take these questions into account and move research into more practical realms of study.

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Appendix A

Research Participants Needed

Objective: Looking for differences in Team Effectiveness between Virtual Teams and Collocated (non-virtual) Teams.

Seeking: Work teams of internet companies with various levels of virtualisation at work.

Be it simple emails to colleagues working at the other end of the office, or everyone working from home via the internet, your work team can take part. We narrowed down the type of company to 'internet companies' to control for and limit the types of work to compare against.

Task: Your work team will be required to each do a 15 minute survey online.

Testing Period: Testing will occur during the months of June 2017 to August 2017.

Reward: Participating teams will receive a summary of the results in a technical report. This report will also suggest best practices for virtual and collocated teams

To Enrol: To participate or for further information regarding the research, procedures, and informed consent, please contact: Joshua Sim (primary researcher) at email address, Joshua.Sim@pg.canterbury.ac.nz

Research is conducted as part of requirement to the Masters of Applied Psychology programme, At the Department of Psychology, University of Canterbury.

Appendix B

Current Question	Anchors
Indicate how much you agree with the following statements:	7 point scale from ‘agree” to ‘disagree’
This team regularly takes time to figure out ways to improve the team’s work processes.	
This team tends to handle the difference of opinion privately rather than addressing them directly as a group.	
Team members get all the information they possibly can from other sources – such as customers, or other parts of the organisation.	
This team frequently seeks new information that leads us to make important changes.	
In this team, someone always makes sure that we stop to reflect on the team’s work process.	
Team members often speak up to test assumptions about issues under discussion.	
This team invites people from outside the team to have discussions with us. E.g. clients, department heads, colleagues from related work teams	

Current Question	Anchors
Indicate how much you agree with the following statements:	7 point ‘agree’ to ‘disagree’ scale
This team has completed tasks in a way we all agree upon.	
I am satisfied with the performance of this team.	
I would want to work with this team in the future.	
As a team, we have learned a lot.	

Current Question	Anchors
Indicate how much you agree with the following statements:	7 point scale from ‘agree” to ‘disagree’
Recently this team seems to be “slipping” in its level of performance and accomplishments. [R]	
Those who receive the work this team produces often have complaints about our work. [R]	
The quality of work provided by this team is improving over time.	
Critical quality errors occur frequently in this team. [R]	
Others in the company who interact with this team often complain about how it functions. [R]	

Current Question	Anchors
How often do the following occur…	7 point scale from ‘never’ to “all the time”
Team projects were delayed. [R]	

The quality of this team's deliverables is excellent.	
Team members often did not meet their commitments. [R]	
Team member's ideas were not effectively communicated. [R]	
There was not enough trust among team members. [R]	
Some team members were not given enough opportunities to contribute. [R]	
Work was fairly distributed across the team.	
Team members were unwilling to take risks. [R]	
I really enjoyed working with other team members.	
Team did not focus on the right questions. [R]	

Current Question	Anchors
How often do you…	6 point frequency scale
Team Distribution	
Collaborate with team members in different time zones.	-Never -At least once a year -Quarterly -Monthly -Weekly -Daily
Work with team members via internet-based conferencing applications.	
Collaborate with team members/colleagues you have never met face to face.	
Collaborate with team members/colleagues who speak different native languages or dialects from your own.	
Workplace Mobility	
Work at different sites. E.g. different offices, from home, client's office.	
Have professional interactions with people outside your company.	
Work with mobile devices for company related purposes.	
Work at home during normal business days.	
Work while travelling. E.g. at airports, cafes or hotels.	
Variety of Practices	
Work on projects that have changing team members.	
Work with team members that have different ways to track their work. E.g. to-do list, excel spreadsheet, project tracking software	
Work with team members that use different collaboration technologies. E.g. text chat, video calls, emails	